NASA News

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For Release:
IMMEDIATE

RELEASE NO: 79-102

NASA SELECTS 25 EXPERIMENTS FOR LASER GEODYNAMICS SATELLITE

The National Aeronautics and Space Administration has selected 25 scientific investigators to use data obtained from its Laser Geodynamics Satellite (Lageos) with ground-based laser ranging systems.

These investigators will study the relative movement and deformation of the Earth's tectonic plates; variations in the motion of the Earth's polar axis and the Earth's rotation; solid Earth and ocean tides; the Earth's gravity field; and satellite orbital perturbations.

August 8, 1979

Seventeen of the principal investigators are affiliated with U.S. universities, private concerns or other government agencies. Seven are from other countries -- France, West Germany, the United Kingdom and the Netherlands.

Lageos is part of NASA's Crustal Dynamics Project which is managed by its Goddard Space Flight Center, Greenbelt, Md. Objective of the project is to improve understanding of the dynamic behavior of the Earth which, in turn, should lead to a better understanding of earthquake mechanisms and crustal processes associated with the emplacement of mineral resources.

Lageos was launched May 4, 1976, into a nearly circular orbit at an altitude of 5,800 kilometers (3,600 miles) and an inclination of 110 degrees to the Equator. The satellite is an aluminum sphere with a brass core. It is 60 centimeters (24 inches) in diameter and weighs 411 kilograms (904 pounds). The surface of the satellite is covered with 426 optical cube corners (reflectors) which retro-direct any incident optical signal.

The initial phase of the Lageos mission was devoted to determination of the precise satellite orbit and to development of the laser tracking systems. In the current phase, Lageos is being tracked by ground-based laser systems at several locations around the world.

By accurately measuring the time for a laser pulse to travel to the satellite and return, the position of the laser system can be determined to about 10 cm (4 in.). By repeatedly observing from several locations, the relative distance between laser locations and any change with time can be determined.

Lageos ranging data will be acquired with mobile laser systems on Kwajalein Island and American Samoa in the Pacific; in Western Australia; at Owens Valley and Goldstone, Calif.; Ft. Davis, Texas; and the Haystack Observatory in Massachusetts. Fixed lasers at the Goddard center; at the McDonald Observatory in Texas; on Maui Island, Hawaii; at a U.S. Air Force site in Florida and others operated by the Smithsonian Astrophysical Observatory in Natal, Brazil; Arequipa, Peru; and Orroral Valley, Australia, also will acquire data.

Lageos data also will be acquired by lasers in several countries in Europe. Data from a transportable laser ranging system, currently under development for NASA at the University of Texas, will be available later this year. This highly mobile, truck-mounted, laser ranging system, designed to obtain precise Lageos ranging data, will support scientific investigations in the continental United States.

Several new space techniques provide unique capabilities for measurements of key geodynamics parameters. For example, crustal plate motion may be accurately measured by laser ranging to satellites, to retroreflectors on the Moon and by very long baseline microwave interferometry using extragalactic radio sources.

The high accuracy determination of the Earth's gravity field and geoid with laser tracking and altimetry from geodetic satellites provides information about the density distribution within the Earth which is essential in interpreting geophysical data relevant to geodynamics and resource location.

Prior to the launch of Lageos, satellite laser-ranging experiments were conducted by affixing laser retroreflectors to satellites performing a variety of missions. Lageos is the first NASA satellite designed solely for laser-ranging experiments.

The analysis and publication of the results portion of the investigations are generally planned for a period of three years and are to be completed by July 1982.

All principal investigators will become part of the Lageos Working Group chaired by the Lageos Project scientist, Dr. David Smith. This working group will meet during the course of the investigations to discuss progress and/or problem areas. The initial meeting is scheduled for August 29 and 30 at the Goddard center.

The Lageos investigations cover four general topic areas. These are: (1) plate tectonics; (2) polar motion and Earth rotation; (3) Earth elasticity and gravity fields; and (4) orbit analysis.

The selected investions and investigators are as follows:

PLATE TECTONICS

Lageos Study of Polar Motion, Plate Rigidity and Plate Motions -- W. Jason Morgan, Princeton University Princeton, N.J.

Precision and Reliability Station Determination in Selected Areas with a View of Investigating the Potentiality to Detect Relative Station Displacements -- L. Aardoom, Delft University of Technology, Netherlands.

Measurement of Fault Motion in the Western United States -- David E. Smith, Goddard Space Flight Center, Greenbelt, Md.

Determination of Worldwide Mobile Station Positions and Geodynamics Reference System -- Peter L. Bender, National Bureau of Standards, Boulder, Colo.

Earth Strain Measurements With the Transportable Laser Ranging System: Field Techniques and Planning -- H. James Dorman, University of Texas, Galveston.

POLAR MOTION/EARTH ROTATION

Earth Rotation Parameters from Lageos and Lunar Laser Ranging (LLR) Data -- Henry F. Fliegel, Jet Propulsion Laboratory, Pasadena, Calif.

Earth-Atmosphere Momentum Exchange and Lageos-Determined Rotation Rates--Richard D. Rosen, Environmental Research and Technology Inc., Concord, Mass.

Solid Earth Dynamics Using Lageos Range Observations -- Byron D. Tapley, University of Texas, Austin.

Determination of Polar Motion and Earth Rotation From Lageos Data -- Deiter Lelgemann, Satellitengeodasie der Technischen Universitat, Munchen, West Germany.

Comparative Studies of Polar Motion by Laser and Doppler Techniques, F. Nouel, Groupe de Recherches de Geodesie Spatiale, Toulouse, France.

Determination of Polar Motion and Earth Rotation from Lageos Data -- David E. Smith, Goddard Space Flight Center, Greenbelt, Md.

Validation, Intercomparison, and Use of Laser Ranging and Radio Interferometric Data for the Determination of Geophysical Parameters Irwin I. Shapiro, Massachusetts Institute of Technology, Boston.

Utilization of Range and Range Difference Observations in Geodynamics -- Ivan I. Mueller, Ohio State University, Columbus.

A proposal for Comparison of Earth Rotation Parameters Derived by Satellite Laser Ranging and Radio Interferometric Techniques -- D. McCarthy, U.S. Naval Observatory, Washington, D.C.

EARTH ELASTICITY AND GRAVITY FIELDS

Use of Artificial Satellite Laser Data for Tidal Studies -- A. Cazenave, Groupe de Recherches de Geodesie Spatiale, Toulouse, France.

The Value of Q at Tidal Frequencies Obtained From Laser Tracking of Lageos and Other Geodetic Satellites -- Clyde C. Goad, National Oceanic and Atmospheric Administration, Rockville, Md.

Gravity Model Improvement Using Laser Data -- W.T. Wells, EG&G/Washington Analytical Services.

ORBIT ANALYSIS

Analyze Satellite Tracking Laser Data in Order to Study Satellite Ephemerides, Solid-Earth and Ocean Tides and Laser System Performance -- E. M. Gaposchkin, Smithsonian Astrophysical Observatory, Boston, Mass.

Investigation of Lageos Laser Data at the GRGS/Grasse -- F. Barlier, Groupe de Recherches de Geodesie Spatiale, Grasse, France.

Development of a New British Orbital Analysis Program -- Arthur J. Meadows, University of Leicester, Leicester, United Kingdom.

Tentative Determination of General Relativity B Coefficient Using Secular Variations of Perigee of Laser Satellites -- M. Lefebvre, Groupe de Recherches de Geodesie Spatiale, Toulouse.

Study of Relativistic Effects on Lageos Orbit Determination and Parameter Estimations -- Chreston F. Martin, EG&G/Washington Analytical Services, Rockville, Md.

Studies of Atmospheric Refraction Effects on Laser Data -- Peter J. Dunn, EG&E/Washington Analytical Services.

Tracking Station Coordinate Determination and Lithospheric Plate Motion Investigation -- Ronald G. Williamson, EG&G/Washington Analytical Services.

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